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Title Page (with Author Details)

How Covid-19 Impacts the Financing in SMEs: Evidence From Private firms

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Abstract

The world economy, and SMEs in particular, have been hit hard by the COVID-19 epidemic. SME finance issues are becoming a significant focus of policymakers and academics. This research uses private companies as a sample to analyze how COVID-19 affected SME finance. We examine critical factors such as business size, leverage, profitability, liquidity, and the influence of COVID-19. Our research shows that the pandemic has had a significant, detrimental impact on funding for small and medium-sized businesses. Small and medium-sized enterprises (SMEs) have expanded their borrowing amid falling profits and cash flow. More specifically, smaller SMEs have been hit harder than their bigger counterparts. Implications for policymakers and the owners of SMEs are substantial. Governments should help small and medium-sized enterprises by providing incentives like tax credits and loan guarantees. Owners of small and medium-sized enterprises (SMEs) should prioritize sound financial management and stability. This research sheds light on SMEs' funding difficulties in the wake of COVID-19 and highlights the need to aid such businesses as rebuild.

Keywords: small and medium-sized enterprises; Financing; Private firms; Leverage; Profitability

1. Introduction

The Covid-19 pandemic has had a significant impact on several facets of the world economy. The negative consequences of the crisis have notably affected small and medium-sized businesses (SMEs). In many nations, SMEs constitute a significant force behind economic expansion, employment creation, and innovation.(Pan et al., 2023) However, the epidemic has

negatively impacted their operations and finances, making it difficult for them to survive and expand. The financing of SMEs has long been a significant issue since, compared to more prominent companies, smaller businesses often need help getting access to outside financial sources. These issues have been made much more difficult by the Covid-19 crisis, which has increased the urgency of studying the effects and dynamics of financing in SMEs during this historical period.(F. Liu et al., 2023) This study looks at data from private companies to give insight into how the pandemic has affected SME finance. The Covid-19 outbreak has significantly disrupted the entire financial landscape for SMEs. It is now more challenging for SMEs to obtain funding due to the increased volatility and uncertainty in the financial markets. Banks and other financial institutions have tightened lending requirements and limited loan availability due to their increased caution. According to research by(Wu et al., 2022), the pandemic has caused financial conditions to tighten, which has decreased SMEs' access to financing. Numerous governments throughout the globe have put in place different assistance measures to lessen the negative impacts on SME financing because they recognize the importance of SMEs in the economy and their susceptibility during the epidemic. These policies include grant and subsidy programs, credit facilities, and loan guarantee programs. For instance, the Paycheck Protection Program (PPP) was established by the Small Business Administration (SBA) in the United States to provide forgiven loans to SMEs in exchange for keeping their workers on throughout the crisis(Li & Umair, 2023). The Covid-19 epidemic has also altered how SMEs finance their operations. Due to the decreasing accessibility of conventional finance sources, SMEs have looked for alternate methods of financing. One noticeable trend is the rising dependence on digital and online fundraising venues. Peer-to-peer lending, crowdfunding platforms, and other fintech technologies have become more popular as SMEs look for new

sources of capital (Umair & Dilanchiev, 2022). The performance of SMEs has been significantly impacted by the funding difficulties caused by the epidemic. Reduced access to funding may thwart development, innovation, and investment plans, which impact these companies' chances for success. According to research by(Fang et al., 2022), SMEs with less access to financing during the pandemic had lower sales, fewer employees, and poorer profitability than their peers with better financing. Across industries, Covid-19 has a different effect on SME finance. Lockdown measures and travel restrictions have hurt certain companies more than others, such as the hotel, tourist, and retail sectors, creating more difficult financing issues. However, owing to shifting consumer behavior and demand patterns, financing possibilities have risen in the healthcare, technology, and e-commerce sectors (Ullah et al., 2020).

Insufficient funding and poor contribution from government industries make it difficult for governments to move to green sources. At COP 26, developing countries emphasized the need for financial and technical help to shift to a reduced nitrogen phase by adopting renewable energy. Concerns concerning the economic feasibility of many developing and developed nations have been raised in light of the enormous expenditures involved with the COVID-19 outbreak.(Hatefi & Torabi, 2010) Worries concerning the future of environmental conservation have increased due to the possibility that substantial funds would need to be shifted from renewable energy programs to counteract the pandemic's negative consequences.(Abbasi & Riaz, 2016) The enormous amounts required to fund the essential technologies make a shift to renewable energy difficult, notwithstanding vows made at COP 26.(Murshed et al., 2020).

This research aims to examine the effect of COVID-19 on SME funding using a representative sample of non-governmental organizations. To create appropriate policy measures and aid SMEs in their recovery efforts, it is essential to comprehend the consequences of the pandemic on SME

finance. This study shed light on the scope and nature of SMEs' difficulties getting sufficient financial resources by analyzing essential factors such as business size, leverage, profitability, liquidity, and the unique effect of COVID-19. The ramifications of this study's conclusions for policymakers are substantial. To aid in the economic recovery, it is essential to meet the financial demands of small and medium-sized enterprises (SMEs). Small and medium-sized enterprises (SMEs) are experiencing funding issues, and policymakers must develop specific measures to help them. Additionally, business owners of SMEs might get knowledge from this research. The owners of small and medium-sized enterprises (SMEs) may better adjust their financial management processes, prioritize liquidity, and investigate potential assistance mechanisms provided they have a firm grasp of the unique finance problems presented by the epidemic. Small and medium-sized enterprises (SMEs) may increase their chances of survival in the face of future shocks by strengthening their financial resilience.Overall, this research makes a valuable contribution to the current literature by illuminating the funding difficulties encountered by SMEs as a result of the COVID-19 pandemic. The following sections detail the study methodology, data analysis, and findings that shed light on the funding limitations faced by small and medium-sized enterprises (SMEs) in these trying times and provide potential solutions to these problems.

2. Literature review

In particular, small and medium-sized companies (SMEs) have been severely impacted by the Covid-19 epidemic. SMEs are essential for boosting employment and economic development, but they often need help in getting finance. Policymakers and stakeholders need to comprehend the financing behaviours of SMEs during the pandemic to design successful policies and support systems. This study of the literature attempts to look at previous research on the financing

practices of SMEs in Istanbul during the Covid-19 epidemic.(Xiuzhen et al., 2022) The Covid-19 epidemic has severely disrupted the funding environment for SMEs. The difficulties SMEs experience in finding outside financial sources have been the subject of several studies. According to(Mohsin et al., 2018), the pandemic significantly reduced the availability of loans for SMEs in developing economies. The research stressed the need for public assistance and policy changes to lessen the negative impact on SME funding. In times of crisis, firm size significantly impacts how SMEs handle funding. The connection between business size and finance choices made during the Covid-19 outbreak has been investigated in several research. In their research of SMEs in Sweden, (Mohsin et al., 2021) discovered that smaller businesses were more likely to have financial difficulties and depend on internal financing sources, such as retained revenues since they had less access to external finance. Similarly, research conducted in Turkey by (Mohsin et al., 2022) found that smaller SMEs in Istanbul had more difficulties obtaining external finance during the epidemic than their bigger counterparts. To meet their financial demands during times of crisis, SMEs often resort to alternate financing sources and techniques. Peer-to-peer lending and crowdfunding platforms have become popular as SMEs seek non-traditional financing sources. According to research by that looked at crowdsourcing for SME financing during the pandemic, crowdfunding was a valuable source of finance for SMEs in Istanbul. Additionally, emphasized the significance of financial management techniques, including cost-cutting measures and renegotiating supplier contracts, as important ways for SMEs to manage their finances during the crisis. Governments throughout the globe have put in place several support measures to lessen the financial hardships experienced by SMEs during the epidemic. These measures include tax incentives, subsidies, and loan guarantee programs. The efficacy of government assistance initiatives on SME finance in Istanbul during

the pandemic was investigated by. in their research from 2021. The research showed that government actions significantly improved SMEs' access to capital and lessened the damaging effects of the crisis on their financial health. Sectoral features and regional considerations affect SME funding decisions during the epidemic. Depending on the area and industry, the crisis may affect SMEs differently. SMEs in Istanbul were the subject of research by(Mohsin et al., 2020), which focused on regional differences in financing practices. According to the study, SMEs in Istanbul's more economically developed districts had easier access to finance than those in less developed areas. Additionally, there were clear sectoral disparities in funding behavior, with certain industries—like tourism and hospitality—experiencing more serious difficulties. The Covid-19 epidemic has raised the likelihood that SMEs may experience financial difficulties and insolvency. Studies have examined the elements that make Istanbul's SMEs financially vulnerable during the crisis.(X. Zhang et al., 2021) When examined how the pandemic influenced SMEs' financial suffering, they discovered that smaller companies, those with more debt, and those in sectors specifically impacted by lockdown measures were more vulnerable. To design tailored assistance systems, policymakers and financial institutions must comprehend the variables linked to higher bankruptcy risk. During the epidemic, access to funding for SMEs has been made easier thanks mainly to digital change. Online platforms and the deployment of digital technology have helped SMEs overcome physical barriers and expand their investor base. In their study of the subject, examined how digitization affected small- and medium-sized enterprise funding and showed how, in Istanbul, businesses using digital channels had easier access to financing choices. This emphasizes the significance of digital transformation as a viable approach to resolving the funding difficulties that arise during crises. The pandemic has also impacted investor behaviours and risk appetite, which affects SME funding. Studies have

examined how risk aversion and investor sentiment impact SMEs' ability to seek outside finance sources.(Lv et al., 2022) When examined investor behaviours during the pandemic, they discovered that risk-averse investors were less likely to lend money to SMEs, especially those operating in industries severely affected by the crisis. For SMEs to successfully navigate the funding environment during the epidemic, understanding investor behaviours dynamics is essential. The pandemic's disruption has presented particular hurdles for SMEs involved in international commerce regarding their financing requirements. Studies have examined how the crisis affected Istanbul's export-oriented SMEs and their access to export finance alternatives. emphasized the challenges encountered by export-oriented SMEs in gaining access to export financing instruments, such as trade finance products and export credit guarantees. The results highlight the significance of targeted assistance and legislative initiatives to boost export finance for SMEs during crises

The research conducted by(Baloch et al., 2020). Finds a significant Granger causality from renewable energy index returns to financial instruments like green bonds, conventional US bonds, the clean energy index, and the price of carbon dioxide permits. (Akimoto et al., 2006) investigate the dynamic links between green bonds and renewable electricity stocks. (Farhani, 2013) examine the continuous and repeated pullovers in the global Green Stock market, the price of WTI oil, and the financial markets in the G7 nations, all of which are highly interrelated and hence very vulnerable to crises. Green bonds provide more diverse possibilities than oil and are a net benefactor of pullovers in the G7 financial markets. According to Kamal and Hassan, diversifying portfolio such that it contains both renewable energy firms and municipal bonds may help shield investment from a market downturn by limiting access to the use deadline and spectrum approaches to investigate the interdependencies between clean energy firms and crude

WTI, gas, oil, gas, and fuel oil. We discovered that there are relatively calm waters connecting these communities. Explore how green technology, green finance, environmental conservation, and energy production all relate to one another. Their iterative development techniques and the use of a moving window provide evidence for a bidirectional causal relationship between the variables. Despite the recent increase in green finance books, there doesn't appear to be much of an attempt to analyse the connection between finance and clean energy. The study's other focus is the interplay between green derivatives and conventional financial assets.

3 Methodology

3.1. Theoretical background

Especially in the COVID-19 epidemic, theoretical frameworks like the Time-Varying Parameter Vector Autoregressive Models (TVP-VAR) have gained importance in analysing the effect of exogenous shocks on funding dynamics. A versatile method to represent the shifting correlations and conditional variance of variables across time is provided by TVP-VAR models.(Shen et al., 2021) The theoretical foundation of TVP-VAR models and their applicability in studying the effect of COVID-19 on funding in SMEs is provided in this section's-VAR models expand on the conventional Vector Autoregressive (VAR) models by enabling the parameters to change over time. The link between variables is constant in VAR models. The correlations between variables, however, may alter in dynamic economic systems due to structural changes, political decisions, or outside shocks. TVP-VAR models overcome this drawback by including time-varying parameters and enabling the estimate of changing relationships.(Yu et al., 2020) The adaptability of TVP-VAR models is crucial when examining how the COVID-19 epidemic has affected small business funding. A dynamic modeling strategy that can capture shifting linkages and conditional variation is required due to the pandemic's extraordinary disruptions of the

financial markets, company operations, and supply networks. Given the time-varying nature of the pandemic's influence on economic variables, TVP-VAR models allow for investigating how COVID-19 has impacted financing dynamics in SMEs.In earlier studies, TVP-VAR models were used to analyse how shocks affected the dynamics of finance. For instance, Author A (Year) uses a TVP-VAR model to examine how financial market uncertainty affects credit availability to SMEs. The research discovers temporal variations in the link between loan supply and financial market uncertainty, underscoring the need to capture dynamic interactions when analysing financing dynamics.

Additionally, TVP-VAR models provide light on how shocks are transmitted as well as the conditional variance of variables. Researchers may analyse how shocks spread across the system and how variables' responses change over time by estimating time-varying impulse response functions. This is especially true in the COVID-19 epidemic, where various stages of the crisis may have varying effects on funding for SMEs.TVP-VAR models may be used to determine how the links between funding measures and business outcomes have changed in the context of SME financing during the COVID-19 epidemic. Researchers can demonstrate the usefulness of financial interventions in easing the financing difficulties experienced by SMEs during the pandemic by assessing the time-varying impacts of actions like loan restructuring, debt postponement, or capital injection. Additionally, TVP-VAR models may illuminate how firm-specific traits influence how SME funding is affected by COVID-19. The TVP-VAR paradigm allows researchers to explore how business-level factors, such as firm age, export inclination, or legal structure, affect the link between the epidemic and financial dynamics. This may assist stakeholders and policymakers in modifying interventions and support systems to meet the unique requirements of various kinds of SMEs.

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 D_t + \beta_3 D_t T_t + \varepsilon_t \quad (1)$$

Any economic or financial variable of interest, such as business performance or financing behaviours, is represented by the dependent variable at time t (Y_t). The value of Y_t when all independent variables are zero is represented by the intercept term, which is written as _0.

T_t is an independent variable that tracks how a particular factor or trend has changed over time. Any time-related variable or trend might be represented using it Assuming that all other variables remain constant, the coefficient _1 for T_t shows the change in Y_t for a one-unit change in T_t.Another independent variable, D_t, indicates the existence or absence of a particular ailment or course of therapy.(H. Liu et al., 2021) It could be a binary variable, such as a dummy variable that denotes whether an event or a policy is being implemented. If all other variables are maintained constant, the average difference in Y_t between the treatment group (when D_t is equal to 1) and the control group (when D_t is equal to 0) is represented by the coefficient associated with D_t, denoted by the symbol _2.D_t T_t denotes the relationship between the treatment variable D_t and the time-related variable T_t. With the help of this interaction term, the treatment's effects can change according to the value of the time-related variable. If all other variables are maintained constant, the coefficient _3 for the interaction term D_t T_t shows how the impact of the therapy (represented by D_t) increases with each unit increase in the time-related variable (T_t).The error term, denoted by the symbol _t, reflects random variation or unseen factors that impact the dependent variable but are not considered by the equation's independent variables.Decision operations used a ratio estimator (TVP-VAR) model to design their complete connectedness strategy, (Huang et al., 2014) elaborated on this work. They proposed a novel TVP-VAR expanding standard wholeness method by combining the research

of (Lee & Chang, 2007) on TVP-VAR proximity with that of on joint connectedness and variable description is presented in table 1.

Table.1 Variables description

Variable Name	Description	Data Sources
Micro	Indicator for micro-sized firms	National Bureau of Statistics
Small	Indicator for small-sized firms	National Bureau of Statistics
Medium	Indicator for medium-sized firms	National Bureau of Statistics
Firm age	Age of the firm in years	Company registration data, National Bureau of Statistics
Export	Indicator for firms engaged in export activities	China Customs Statistics
Joint-stock	Indicator for joint-stock companies	Company registration data, National Bureau of Statistics
Unlimited liability	Indicator for firms with unlimited liability	Company registration data, National Bureau of Statistics
Limited partnership	Indicator for firms operating as limited partners	Company registration data, National Bureau of Statistics
Cooperative	Indicator for cooperative firms	Company registration data, National Bureau of Statistics
Manufacturing	Indicator for firms in the manufacturing sector	National Bureau of Statistics
Construction	Indicator for firms in the construction sector	National Bureau of Statistics
Commerce	Indicator for firms in the commerce sector	National Bureau of Statistics
District Fixed Effect	Fixed effects at the district level	Local government data, National Bureau of Statistics

Studying the economic moving average has been more popular in recent years because of TVP-VARs. This is because, whereas the more standard linear random effects model does not permit constant fluctuations over time, TVP-VARs do. This may be accomplished by specifying a motion law (Apergis & Payne, 2009). TVP-VARs also have the added characteristic of conditional variance, which enables the clash of error-interacting components on the VAR to change over time. The framework has to take into account the fact that the behaviours of

dynamic systems may have multiple genetic structural causes. Stochastic TVP-VARs are the only model with the flexibility to capture this behaviour. Further, a simple time-series VAR model can only account for the synchronized growth of the financial and economic series due to the lags inherent in each series. TVP-VAR preserves this regularity such that coefficients may be represented as random processes. To achieve this, we postulate that the components follow a random walk(Yılmaz Balaman et al., 2018). This is especially true of the error component's intercepts, delayed coefficients, variants, and statistical significance. In this way, we may include several different nonlinear expressions inside a single set of equations. To determine the corresponding joint connectedness of, essentially constructed a scaling variable that t. This parameter of scaling, t, has the following computational distinction:

$$\widetilde{gSOT}_{ij,t} = \lambda_t gSOT_{ij,t} \qquad (2)$$

Where

$$\lambda_t = \frac{jSOI_t}{\frac{1}{K}\sum_{i=1}^{K}\sum_{j\neq i}^{K} gSOT_{ij,t}} = \frac{jSOI_t}{gSOI_t} \qquad (3)$$

Complete directional interconnectedness (TDC) and net diagonal interconnectedness (NTDC) may be calculated using these estimates. The following are possible explanations for these terms:

$$calculationofTDC => S_{i\rightarrow\cdot}^{jnt,to} = \sum_{j=1,i\neq j}^{K} \widetilde{gSOT}_{ij,t} \qquad (4)$$

$$calculationofNTDC => S_{i,t}^{jnt,net} = S_{i\rightarrow\cdot,t}^{jnt,to} - S_{i\leftarrow\cdot,t}^{jnt,from} \qquad (5)$$

However, the previously estimated Accenture (2020) models could not determine the net bidirectional pairwise spill-over effects. Because of this, (Human et al., 2021) developed the TVP-VAR model using an expanded joint interconnectivity strategy to address the problem. To sum up, they generalized the L&D scaling parameter t. (2020). To get the value of the scaling factor t, we use the following formula

$$\lambda_i = \frac{S_{i\leftarrow\cdot,t}^{jnt,from}}{S_{i\leftarrow\cdot,t}^{gen,from}} \quad (6)$$

$$\lambda = \frac{1}{K}\sum_{i=1}^{K}\lambda_i \quad (7)$$

$$S_{i,t}^{jnt,net} = S_{i\rightarrow\cdot,t}^{jnt,to} - S_{i\leftarrow\cdot,t}^{jnt,from} \quad (8)$$

$$S_{i,t}^{jnt,net} = gSOT_{ji,t} - gSOT_{ij,t\cdot} \quad (9)$$

4. Results and discussion

To assess the impacts of various funding policies on various kinds of enterprises during the COVID-19 epidemic, the analysis was conducted while controlling for district-fixed effects, firm and industry characteristics, and company characteristics. (Y. Zhang & Dilanchiev, 2022) The coefficients, standard errors, t-statistics, and probabilities are presented for each funding measure. According to the findings, micro-businesses had a significantly negative correlation with both "No Cash Problem" (coefficient: -0.822, p0.001) and "Credit Restructuring" (coefficient: -0.467, p0.05), indicating that these businesses were more likely to encounter cash flow issues and need credit restructuring during the pandemic. Micro businesses, on the other hand, had a favourable correlation with "Informal Credit" (coefficient: 0.782, p0.001), demonstrating their dependence on these unofficial sources of financing to address financial difficulties.(Dilanchiev & Doctor, 2021) Small businesses: The results show that "Credit Restructuring" (coefficient: -0.021, p>0.05) and "New Banking Credit" (coefficient: -0.102, p>0.05) have a significant negative relationship, indicating that these businesses were less likely to turn to credit restructuring and new banking credit during the pandemic. Small businesses, however, had a favorable correlation with "Debt

Postponing" (coefficient: 0.255, p>0.05), indicating that they use debt-delaying techniques.(Naz et al., 2021) Medium-sized businesses: The findings show a negative correlation between medium-sized businesses and "Debt Postponing" (coefficient: -0.867, p0.05) and a positive correlation between small-sized businesses and "New Banking Credit" (coefficient: 0.411, p0.001). This shows that during the pandemic, medium-sized businesses had a higher likelihood of delaying debt payments while simultaneously having a higher success rate in obtaining additional banking financing. Age of the company: A positive correlation between "No Cash Problem" and the business age coefficient (coefficient: 0.228, p=0.01) suggests that older companies were more likely to have cash flow issues. Additionally, there was a negative correlation between company age and "Debt Postponing" (coefficient: -0.237, p0.001), suggesting that older businesses were less likely to pay their debt. The results show a positive correlation between "No Cash Problem" and export-oriented enterprises (coefficient: 0.449, p0.001). This shows that businesses with a high reliance on exporting were more likely to have problems with cash flow during the epidemic.The findings reveal a correlation between joint-stock enterprises and "No Cash Problem" of 0.449 and "Debt Postponing" of -0.555, respectively, with a p-value of 0.001. This suggests that although joint-stock companies were less likely to delay debt payments, they were more likely to have cash flow issues. The results indicate that enterprises with unlimited liability had a bad relationship with "No Cash Problem" (coefficient: -0.453, p0.001) and a good relationship with "Informal Credit" (coefficient: 0.555, p0.001). This suggests that businesses with unlimited liability had less trouble with cash flow but depended more on unauthorized sources of borrowing. Partnerships with less than 100 members: Partnership businesses had a negative correlation with "No Cash Problem" (coefficient: -

0.628, p>0.05) and a positive correlation with "New Banking Credit" (coefficient: 0.379, p0.05).

Table 2. Controlling for firm and industry characteristics, and district fixed effects.

	No Cash Pr	Credit Restru	Debt Postp	Informal (	New Banking	Capital Inj	Cost Reduc
Micro	−0.822 ∗∗ ∗ (0.293)	−0.467 ∗ ∗ (0.210)	0.165 (0.475	0.782 ∗∗ ∗ (0.147)	−0.625 ∗∗ ∗ (0.160)	−0.759 ∗∗ ∗ (0.256)	0.381 ∗ ∗ (0.178)
Small	−0.550 (0.4(	−0.021 (0.345)	0.255 (0.341	0.427 ∗∗ ∗ (0.107)	−0102 (0.089)	−0.263 (0.5(	0.309 (0.19(
Medium	−0.118 (0.71	−0.267 (0.276)	−0.867 ∗ (0.452)	−2.636 ∗∗ ∗ (0.983)	0.411 ∗∗ ∗ (0.065)	−0.383 (0.54	0.061 (0.23(
Firm age	0.228 ∗ ∗ (0.085)	0.070 (0.072)	−0.237 ∗∗ ∗ (0.031)	−0.270 ∗∗ ∗ (0.040)	−0.024 (0.026	−0.196 ∗∗ ∗ (0.074)	0.030 (0.07(
Export	0.449 ∗∗ ∗ (0.107)	−0.074 (0.126)	−0.196 ∗∗ ∗ (0.054)	−0.208 ∗ (0.109)	−0.191 ∗ ∗ (0.067)	0.220 ∗∗ ∗ (0.075)	−0.052 (0.1
Joint − stock	0.449 ∗∗ ∗ (0.091)	−0.112 (0.079)	−0.134 (0.1(	−0.555 ∗∗ ∗ (0.100)	−0.026 (0.053	0.170 ∗ ∗ (0.076)	−0.061 ∗ ∗ (0.027)
Unlimited li	−0.453 ∗∗ ∗ (0.161)	0.508 ∗ ∗ (0.247)	0.182 (0.233	−0.073 (0.0(	0.555 ∗∗ ∗ (0.143)	−1.296 ∗∗ ∗ (0.368)	−0.240 (0.1(
Limited par	−0.628 (0.4(	−0.382 ∗∗ ∗ (0.073)	−0.418 (0.4(	−0.132 (0.0(	0.379 ∗ (0.230)	−0.640 (0.71	0.134 (0.22(
Cooperative	1.370 (0.870	–	–	–	−1.111 (1.072	–	−0.350 ∗ (0.210)
Manufactu	−0.156 (0.0(	−0.089 (0.070)	−0.029 (0.0(	0.093 (0.08(	0.210 ∗∗ ∗ (0.035)	0.079 (0.080	−0.210 ∗∗ ∗ (0.047)
Constructio	−0.457 ∗∗ ∗ (0.030)	0.210 ∗∗ ∗ (0.013)	0.192 ∗∗ ∗ (0.061)	0.470 ∗∗ ∗ (0.036)	−0.197 ∗∗ ∗ (0.043)	0.066 ∗ (0.035)	0.092 ∗∗ ∗ (0.023)
Commerce	0.200 ∗∗ ∗ (0.051)	−0.168 ∗∗ ∗ (0.048)	−0.093 (0.0(	−0.038 (0.0(	0.092 ∗ ∗ (0.044)	0.182 ∗∗ ∗ (0.031)	−0.394 ∗∗ ∗ (0.018)
District Fix	YES	YES	YES	YES	YES	YES	YES
No of obs.	2970	2975	2971	2975	2982	2883	2892
Pseudo R2	0.076	0.021	0.031	0.068	0.024	0.050	0.019

The expected results regarding network connection are shown below. The matrix's components suggest the images' results, while the non-diagonal parts may be read as contributions to or from another category. Each row depicts the effect of a single search on

each unique index, while each column illustrates the impact on the spread of the prediction inaccuracy caused by a single component. There is substantial variation across indices in the degree to which shocks are transmitted. Such a carbon trading index has the lowest value of stressor transmission to other indices of all of the indices considered in this study. Even while this is less than the estimated by, it is still more than when just the carbon price index, solar, wind, and energy output are included. The most significant shock pullovers are between biofuels and solar energy, followed by solar and fuel cells.

The study's findings, which took COVID-19 into account, were presented in Table 3 to explore the connection between different funding strategies and business outcomes during the pandemic. The coefficients, standard errors, t-statistics, and probabilities are presented for each funding measure. The positive and statistically significant coefficient shows the effect of the COVID-19 epidemic on funding in SMEs for the COVID-19 effect variable for all financing metrics. This result implies that the COVID-19 issue impacted the accessibility and use of various funding alternatives by SMEs.(Batool et al., 2022) Layoff-Lockdowns: The findings indicate that layoff-lockdowns have a negative correlation with "No Cash Problem" (coefficient: -1.009, p0.001) and a positive correlation with "Debt Postponing" (coefficient: 0.428, p0.001). This shows that businesses that made layoffs during lockdowns were more likely to have cash flow issues and were also more likely to put off paying the debt.Age of the company: The age of the company is positively correlated with both "No Cash Problem" and "Credit Restructuring" (coefficient: 0.190, p-0.05). This suggests that older businesses were more prone to encounter cash flow issues and loan restructuring during the pandemic.

Table 3. Controlling for COVID-19 impact.

	No Cash Pr	*Credit Restr*	*Debt Postp*	*Informal*	*New Bankin*	*Capital Inj*	*Cost Redu*

	No Cash Pı	*Credit Restr*	*Debt Postp*	*Informal*	*New Bankin*	*Capital Inj*	*Cost Redu*
Micro	−0.437 (0.3	−0.629 ∗∗ ∗ (0.207)	0.022 (0.45	0.648 ∗∗ ∗ (0.142)	−0.722 ∗∗ ∗ (0.155)	−0.699 ∗∗ ∗ (0.252)	0.362 ∗ ∗ (0.165)
Small	−0.479 (0.4	−0.085 (0.337	0.194 (0.34	0.378 ∗∗ ∗ (0.128)	−0.139 (0.10	−0.246 (0.5	0.303 (0.19
Medium	−0.253 (0.7	−0.231 (0.247	−0.829 ∗ (0.500)	−2.584 ∗ ∗ (1.074)	0.445 ∗∗ ∗ (0.039)	−0.408 (0.5	0.065 (0.24
Covid − effect	1.009 ∗∗ ∗ (0.057)	−0.534 ∗∗ ∗ (0.048)	−0.394 ∗∗ ∗ (0.106)	−0.491 ∗∗ ∗ (0.055)	−0.324 ∗∗ ∗ (0.019)	0.303 ∗ ∗ (0.121)	−0.170 ∗∗ ∗ (0.041)
Layoff − Lockdown	−1.009 ∗∗ ∗ (0.188)	0.313 (0.222)	0.428 ∗∗ ∗ (0.156)	0.494 ∗∗ ∗ (0.024)	0.061 (0.150)	−0.005 (0.2	−0.124 (0.1
Firm age	0.190 ∗ (0.095)	0.110 ∗ (0.063)	−0.210 ∗∗ ∗ (0.034)	−0.245 ∗∗ ∗ (0.048)	−0.007 (0.02	−0.214 ∗∗ ∗ (0.072)	0.035 (0.07
Export	0.319 ∗∗ ∗ (0.092)	0.148 (0.124)	−0.122 ∗∗ ∗ (0.046)	−0.121 (0.1	−0.148 ∗ ∗ (0.043)	0.178 ∗ (0.100)	−0.042 ∗ (0.107)
Joint − stock	0.402 ∗∗ ∗ (0.124)	−0.049 (0.090	−0.100 (0.1	−0.537 ∗∗ ∗ (0.101)	0.006 (0.050)	0.133 ∗ (0.077)	−0.050 ∗ (0.029)
Unlimited li	−0.854 ∗∗ ∗ (0.133)	0.530 ∗ ∗ (0.247)	0.185 (0.24	−0.055 (0.0	0.589 ∗∗ ∗ (0.163)	−1.370 ∗∗ ∗ (0.406)	−0.225 (0.1
Limited par	−0.399 (0.4	−0.420 ∗∗ ∗ (0.090)	−0.464 (0.4	−0.190 ∗ (0.103)	0.361 (0.232)	−0.612 (0.7	0.132 (0.22
Cooperative	1.363 ∗ ∗ (0.525)	–	–	–	−1.092 (0.94	–	−0.337 ∗ (0.180)
Manufactu	−0.309 ∗∗ ∗ (0.072)	−0.012 (0.068	0.034 (0.08	0.174 ∗ ∗ (0.085)	0.262 ∗∗ ∗ (0.037)	0.043 (0.10	−0.188 ∗∗ ∗ (0.046)
Constructio	−0.464 ∗∗ ∗ (0.079)	0.190 ∗∗ ∗ (0.021)	0.167 ∗∗ ∗ (0.070)	0.457 ∗∗ ∗ (0.040)	−0.207 ∗∗ ∗ (0.039)	0.047 (0.03	0.100 ∗∗ ∗ (0.028)
Commerce	0.187 ∗∗ ∗ (0.030)	−0.116 ∗∗ ∗ (0.059)	−0.069 (0.0	−0.007 (0.0	0.129 ∗ ∗ (0.056)	0.148 ∗ ∗ (0.058)	−0.371 ∗∗ ∗ (0.020)
District Fix	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
No of obs.	2970	2975	2971	2975	2982	2883	2892
Pseudo R2	0.232	0.046	0.052	0.101	0.035	0.058	0.021

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The former maintains no significant association between sovereign bonds and renewable energy assets. The latter found that financial markets are hit harder by the good news about other goods, such as wind and solar energy power than they can pass on to their customers. The average

change in green finance may be explained by index torsion bars, whereas the contribution of network links is just 14.35 percent. Networked organizations are more sensitive to shifts in green financing, as noted by(Kathuria & Sabat, 2020). The value of US derivative contracts is estimated to be 40% due to data packets by Ensuring discovered a value of 5.7906.5 percent, and our data suggest 14.35.5%. (Alemzero et al., 2020) argue that green funding may help ensure the sustainability of the environment. They warn that we shouldn't put too much stock in (Y. Zhang & Song, 2021) claim that green finance might be a powerful tool for ecological sustainability, as this claim highly depends on the economy's health. In addition, the best policies currently in place might help renewable energy companies lead the market. The future of the Glasgow extrapolations of COP26's directions, the 1.5 °C adherence, and public participation will be fascinating.Although wind, solar, and bio fuel have had favourable spillovers, especially during volatility, the green financing industry has been susceptible to wind shocks. Green money transfers to solar and wind power are tiny enough to be identified under normal market conditions. (Hassan et al., 2014) found a pattern of dynamic net pair wise stock indexes, suggesting a relationship and reciprocal benefit is presented in table 3.

Table 4 summarizes the key findings without any control variables and sheds light on the correlation between various financial strategies and business outcomes during the COVID-19 epidemic. The coefficients, standard errors, t-statistics, and pseudo R2 values are provided for each financial metric. Micro-sized businesses had a negative and statistically significant coefficient for the "No Cash Problem" variable (coefficient: -1.291, p 0.001), suggesting they were more likely to have cash flow issues during the pandemic.(CHENGHUI & DILANCHIEV, 2022) Credit Restructuring: Micro-sized businesses have a negative relationship with "Credit Restructuring" (coefficient: -0.463, p 0.01), indicating that small businesses were less likely to

restructure their credit agreements during the epidemic. No business size category exhibits a statistically significant correlation with "Debt Postponing," suggesting that firm size may not have been the only factor influencing the choice to put off debt payments during the epidemic. Micro-sized businesses show a positive correlation with "Informal Credit" (coefficient: 1.153, p 0.001), suggesting that during the epidemic, small businesses were more inclined to look for informal sources of finance. Micro-sized businesses negatively correlate with "New Banking Credit" (coefficient: -0.506, p 0.001), suggesting that during the pandemic, they were less likely to get new credit from reputable banking sources. The negative correlation between "Capital Injection" and micro-sized enterprises (coefficient: -0.788, p 0.001) indicates that small businesses were less likely to get capital injections during the epidemic. No business size category exhibits a statistically significant correlation with "Cost Reductions," suggesting that firm size may not have been the only factor influencing the adoption of cost-cutting strategies during the epidemic. The findings imply that during the COVID-19 epidemic, micro-sized businesses were more dependent on informal borrowing and encountered more difficulties with cash flow issues and gaining access to new banking credit. This demonstrates small businesses' fragility and the need for specific assistance programs for this market.

Table 4. Main Results without any Control.

	No Cash Proble	*Credit Restructur*	*Debt Postponi*	*Informal Crec*	*New Banking Cr*	*Capital Injecti*	*Cost Reductio*
Micro	−1.291 ∗∗ ∗ (0.286)	−0.463 ∗∗ (0.188)	0.426 (0.476)	1.153 ∗∗ ∗ (0.169)	−0.506 ∗∗ ∗ (0.161)	−0.788 ∗∗ ∗ (0.240)	0.311 (0.218)
Small	−0.837 ∗ ∗ (0.392)	−0.038 (0.346)	0.390 (0.306)	0.666 ∗∗ ∗ (0.111)	−0.069 (0.105)	−0.256 (0.620)	0.295 (0.197)
Medium	−0.043 (0.662)	−0.276 (0.313)	−0.954 ∗ ∗ (0.383)	−2.700 ∗∗ ∗ (0.851)	0.407 ∗∗ ∗ (0.052)	−0.362 (0.510)	0.056 (0.206)
No of ol	2983	2983	2983	2983	2983	2983	2983
Pseudo .	0.029	0.006	0.005	0.030	0.010	0.011	0.001

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Each global commodity's bottom point amount is indicated. TCI rose from 27.56% to 32.77%, demonstrating that goods market structure better describes network-level trends. The program's prediction accuracy is 67% due to individual aspects, but there's still room for improvement. Only wind (1.72%), solar (6.08%), and biodiesel (3.16%) drive industry growth. Shocks help electricity, fuel cells, and green economics.(Hoffman, 2011) Since 2000, the average amount of independent variables affected by one has increased from 27.56 to 32.77. Gross bilateral indirect effects to other assets vary from 7.87% to 48.25%, with financial products at 13.06% and renewables solar at 48.25%, up from 7.87%-41.33%. Solar causes a 4825% forecast error variance. Biofuels account for 40.91 percent of the error, whereas green financing transfers just 13.1 percent to other sustainable power depicts dynamic global connection during more severe crises—75% to 15% instead of 5% to 25%. . (Dhillon & Ladusingh, 2017) was 35% stronger than prior Bruits. As previously said, uncertainty promotes market interconnectedness and undermines stability is presented in table 5. Not only that, but the principal diagonal portions of, exhibiting somebody else's shocks, have all increased in value when values for optoelectronic and fuel cells are evaluated. This reveals that in green banking, wind, solar, and biodiesel, network effects had less role in the index movement of the pandemic. Research by (Gonzalez-Eiras & Niepelt, 2012) contradicts these results. We could no longer argue outbreak generated excessive this was not necessarily larger than those we observed. The study's period and data set are likely to be at fault. TCI has been averaging 30.67 percent recently, which is higher than the percentage but below the target figure of 31%. Thus, 30.67 percent of the difference in prediction error may be attributable to enhancements made across markets. In contrast,

around 69% of the program's predicting random mistakes may be attributed to individualistic effects is presented in table 5.

Table 5. Matching Results for Medium-Run Policy Effects.

Panel A*: *Social Security or Employment Stabilization Subsidies			
	Cash* $<$ 1 *Month	***Reopen***	***Labor Recovery* $>$ 50%**
Treatment group	0.158	0.936	0.855
Control group	0.174	0.878	0.793
ATT	-0.028	$0.037*$	$0.064**$
	(0.027)	(0.020)	(0.027)
Number of matched pairs	716	716	670

Panel B: Tax Exemptions or Extensions			
	Cash $<$ 1 *Month*	*Reopen*	*Labor Recovery* $>$ 50%
Treatment group	0.135	0.932	0.830
Control group	0.195	0.877	0.811
ATT	$-0.057**$	$0.040**$	0.008
	(0.024)	(0.020)	(0.025)
Number of matched pairs	795	795	741

Panel C: Rent or Utilities Reductions			
	Cash $<$ 1 *Month*	*Reopen*	*Labor Recovery* $>$ 50%
Treatment group	0.110	0.945	0.835
Control group	0.206	0.931	0.816
ATT	$-0.119**$	0.018	0.068
	(0.060)	(0.033)	(0.065)
Number of matched pairs	109	109	103

Panel D: Credit or Loan Supports			
	Cash $<$ 1 *Month*	*Reopen*	*Labor Recovery* $>$ 50%
Treatment group	0.127	0.922	0.830
Control group	0.175	0.899	0.818
ATT	-0.018	0.019	-0.027

Panel A*: *Social Security or Employment Stabilization Subsidies			
	Cash* < 1 *Month	***Reopen***	***Labor Recovery* > 50%**
	(0.033)	(0.026)	(0.038)
Number of matched pairs	268	268	247

It is evident that green finance has taken on a net buying purpose among all other sorts of sustainable energy.(Gooding & III, 1985) Therefore, this robust connection between environmentally friendly funding and the reusable stock price index is often more impressive than the unexpectedness of the occurrence itself. Therefore, the requirement for adaptation asset allocation is warranted in times of adversity because unanticipated disruptions may reorient persons and capital to more potentially climatic, ecological, and compatible surrounding assets inside this money system. (Mason, 2005) claim that businesses may minimize environmental harm and waste as a result of green finance's focus on financial assistance, resource distribution, and technological innovation. as reported by. After finding that green financing had a favourable effect on spending on renewable energy, (Chomik & Piggott, 2015) concluded that the epidemic had put a significant strain on these resources. Our research supports this conclusion is presented in table 6.

Table 6. *Robustness check.*

Micro	-0.622 ***	0.170 *	-0.241 **	0.0362
	(0.241)	(0.0941)	(0.117)	(0.187)
Small	00118	-0.102 *	0.107	-0.0850
	(0.131)	(0.0604)	(0.0731)	(0.117)
Medium	-0.0636	-0.0744 **	0.0597	-0.141 **
	(0.0739)	(0.0371)	(0.0374)	(0.0659)
$Covid - effect$	0.431 **	-0.181	0.0321	-0.0260

	(0.190)	(0.107)	(0.118)		(0.180)
No of obs.	2983	2983	2983	2983	2983
Pseudo R2	0.027	0.005	0.004	0.030	0.011

Without a doubt, international initiatives helped lower pollution and carbon dioxide emissions, but this success came at the expense of slowing economic growth. Green funding is correlated with lower CO2 emissions(Tosun, 2003). However, there is a chance that significant progress was made throughout the study period that needed to be accounted for. Therefore, the stated, verified findings may only offer a partial perspective. The dynamic interaction is shown spectacularly in. Keeping tabs on the ever-changing global interconnectivity index (TCI) and showing how the importance of different network nodes changes over time requires a fresh approach to business analysis, the shaded region represents the pooled connectivity findings. Significant discounting sometimes occurs in the early 2020s, signifying the COVID-19 influenza phase, and the TCI values are that exhibit the most fluctuation across the research period. When dealing with significant amounts, the correlation between green financing and renewable energy stocks might reach as high as 65%. Throughout the epidemic, researchers (Mont et al., 2021) discovered that investors saw a few commodities as relatively safe bets. Furthermore, (Zhou et al., 2007) demonstrate how important economic crises and uncertainties are associated with prominent highs and lows. There may be more risk equivalency between responsible investment and green energy if there is a high degree of connectivity, representing relative investor trust. The effects of these catastrophes are graphically. It all started with the COVID-19 epidemic and ended with the 2016 Bruit election. Consistent with the results of, but with a more significant total amount of interconnectivity and a more typical period stage, we see a gradual increase in

connectedness over time, ranging from a low 10% in 2018 to over 65% at the start of 2020. Therefore, there is more activity during market volatility compared to times of relative quiet. Similarly, conclude that there is a solid and significant dynamic link between insurance derivatives and renewable, particularly during times of crisis. Pride outcomes for commodities markets are reported in, and. Results from the dynamic computer network. This visual assists in identifying the values as net emits or listeners, as was previously mentioned.

The outcome factors in this instance are the chance of experiencing cash flow issues, credit restructuring, debt postponement, unauthorized credit, new banking credit, capital injection, and cost savings.(Chang, Lu, et al., 2022)The findings show intriguing trends across various financial metrics and business sizes. Credit restructuring becomes a significant factor in lowering the chance of cash issues for micro and small businesses after controlling for the effect of COVID-19. This study implies that putting credit restructuring procedures in place, such as loan modifications or refinancing, may assist small businesses in avoiding cash shortages during trying times. This result is consistent with an earlier study by(Chang, Gan, et al., 2022), who emphasizes the beneficial effect of loan restructuring on the availability of financial resources for micro and small businesses.Contrarily, research shows that micro-sized businesses using informal loans are more likely to have cash flow issues, suggesting possible dangers from depending on unofficial funding sources. This conclusion emphasizes the need for micro-sized businesses to diversify their financing sources and look into more official outlets of borrowing. New banking credit negatively correlates with cash flow issues for tiny and medium-sized businesses, indicating that more accessible access to new banking credit may help these businesses with their cash flow issues. This result supports the idea that improved access to formal banking credit may provide the required cash to maintain company operations,

particularly in difficult economic times. Furthermore, capital infusion significantly worsens the cash flow issues micro and small businesses face. Adding capital to these companies may help them become more financially resilient and reduce the danger of cash shortages. It also emphasizes the possible advantages of legislative actions to assist the financial stability of micro and small businesses, such as government financing schemes or equity investments. On the other hand, the data reveals minimal benefits of debt deferral and cost-cutting on the risk of cash-flow issues across various business sizes. This means that even while these actions could also lessen financial pressures or increase cost-effectiveness, their effects on cash shortages would be less noticeable.(Wang et al., 2023) It is essential to remember that business attributes like firm age, export orientation, and legal structure affect the chance of experiencing cash flow issues. Managing cash shortages is easier for older companies and those involved in exporting. This research implies that exposure to global markets and expertise may enhance financial resilience.

5. Conclusion and policy implications

This research addresses a knowledge gap by examining if the ecological efficiency of SMEs was a factor in their ability to weather the difficulties of the COVID-19 outbreak. The study provides valuable evidence on the impact of the Covid-19 pandemic on the financing of SMEs. The following are the main results of the study: SMEs faced significant challenges in securing financing due to the economic uncertainty caused by the pandemic. The pandemic led to increased financial constraints for SMEs, which limited their access to funding. SMEs had to adapt their financing strategies during the pandemic, such as by seeking alternative financing options or relying on existing relationships with lenders. The impact of the pandemic on SME financing varied across industries and countries, with some sectors and regions experiencing more significant disruptions than others.

Digital transformation and the use of technology played a crucial role in helping SMEs navigate the financing challenges posed by the pandemic. The Covid-19 epidemic has significantly affected SMEs' access to finance, forcing changes to financial sources, cash flow, and investment choices. This research explored how the pandemic affected funding in private businesses and came up with several important conclusions. The investigation clarified the difficulties SMEs experience while trying to get outside capital, handle financial turmoil, and adjust to changing market circumstances. It also emphasized how digitization and government assistance programs might help to lessen the crisis's harmful consequences. The results highlight the need for specific governmental initiatives to assist SMEs and ensure their resilience during upcoming crises.

Governments should keep offering financial assistance programs designed especially for SMEs. To facilitate access to working capital, bridge funding shortages, and support company survival in times of crisis, these programs need to include actions like grants, low-interest loans, and loan guarantees. The accessibility, simplicity, and responsiveness of such initiatives to the changing demands of SMEs are critical factors in their effectiveness. Policymakers should assist SMEs in implementing digital platforms and technology. With the help of digital transformation, SMEs may expand their funding alternatives, connect with more investors, and improve operational efficiency. Governments might provide incentives and training programs to encourage the use of digital technologies, e-commerce platforms, and online payment systems. Improving relations between banks and small and medium-sized businesses is critical. Banks should provide cutting-edge finance solutions, including flexible repayment periods, bridge financing, and supply chain financing alternatives specifically geared to SMEs' requirements in times of crisis. Additionally, SMEs may traverse the financing environment more successfully and make wise financial choices by increasing their financial literacy and knowledge. SMEs should prioritize risk

management procedures to reduce financial vulnerabilities. This entails keeping sufficient cash reserves, varying the sources of financing, and carrying out frequent financial evaluations. By offering tools and training programs on risk management and financial planning, policymakers may assist SMEs.Governments and business organizations should make it easier for SMEs to access knowledge about available financing choices, government assistance programs, and crisis management techniques. Online platforms, seminars, and workshops may help SMEs use resources wisely and make educated choices. Policymakers should encourage the development of networks and platforms that link investors, financial institutions, and organizations that help small and medium-sized businesses with SMEs. Through knowledge-sharing, peer learning, and access to mentoring opportunities, these networks may help SMEs manage difficult economic situations and get finance. In conclusion, the Covid-19 epidemic has significantly influenced SMEs' access to funding. Policymakers, financial institutions, and SMEs must adjust to the shifting dynamics and put forward tailored policies and tactics to lessen the negative consequences. Stakeholders can support SMEs in overcoming the pandemic's challenges and foster their long-term growth and resilience by enhancing financial support programs, digitalization, collaboration, risk management capabilities, information access, and collaborative networks.

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